Growth in nurse prescribing of antibiotics: the Scottish experience 2007-13

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Title: The growth in nurse prescribing of antibiotics: the Scottish experience 2007-2013

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Short running title: nurse prescribing of antibiotics

Key words (3-5): nurse, prescribing, descriptive analysis

Synopsis:

Objective: To retrospectively analyse patterns of primary care antibiotic prescribing by nurse prescribers in Scotland.

Patients and methods: Data on dispensed antibiotic prescriptions written by nurse prescribers 2007-2013 were obtained from the Prescribing Information System, a database of all NHS prescriptions dispensed in Scotland.

Results: Since 2007, there has been a steady increase in the volume of antibiotic prescribing in primary care undertaken by nurse prescribers. There was considerable variability in the frequency of antibiotic prescribing among nurses and across NHS boards. Since 2007, an increasing proportion of antibiotics prescribed by nurses are those recommended for first line empirical treatment of infection with a reduction in the proportion of broader spectrum agents. Other measures of prescribing quality; duration of treatment of adult females with urinary tract infection and use of recommended doses have improved since 2007.

Conclusion: This paper is the first to present an analysis of data on antibiotic prescribing in primary care by nurse prescribers. Inappropriate prescribing is a problem and given the impact that antibiotic prescribing has on Antimicrobial Resistance (AMR) it is important that the prescribing behaviour of nurses is explored. This is especially significant as this is a growing body of prescribers who predominately work in the community where the majority of antibiotics are prescribed. This analysis showed that practice varies across NHS Boards and between prescribers and although more information is needed to establish if nurse prescribers are prescribing appropriately, some quality indicators may suggest that they are following best practice.

Introduction

Nurse prescribing has been implemented in several countries, including the United States (US), Australia and Ireland; however, no other country has such extended prescribing rights as the United Kingdom (UK).[1] In 2005, the Committee on Safety of Medicines (CSM) concluded that suitably trained and qualified nurses should be able to prescribe any medicine from the British National Formulary (BNF) provided the prescriber is acting within their competence. This came into effect in 2006, with the publication of "Non Medical Prescribing: Guidance for Independent Nurse Prescribers and for Community Practitioner Nurse Prescribers in Scotland"[2] in Scotland, and the Nursing & Midwifery Council "Standards of proficiency for nurse and midwife prescribers" across the whole of the UK.[3]

There are three types of nurse prescribers; Supplementary Prescribers (based on a partnership between the doctor and the nurse where the nurse has the ability to prescribe a drug listed in a patient-specific clinical management plan once the patient has been diagnosed by a doctor), Community Practitioner Nurse Prescribers (prescribe from a limited formulary called the Nursing Formulary for Community Practitioners which includes over-the-counter drugs, dressings and applications) and Nurse Independent Prescribers. This final group can prescribe any licensed and unlicensed drugs within their competence and therefore it is this group who are most likely to prescribe antibiotics. At the time that this nurse prescribing development arose (2002), the UK House of Lords debated the prescribing extensions with regard to the steps needed to "guard against an increasing prevalence of antibiotic resistant organisms in the light of the Nurse Prescribing Regulations".[4]

The number of nurse prescribers in the UK (including supplementary, community practitioner and independent prescribers), obtained from Nursing and Midwifery

Council (NMC) data received in October 2013, was 65080 (this includes 6514 nurse prescribers in Scotland). These numbers have increased each year since 2006.[5] Figures from NHS Education for Scotland suggests that, in 2013; around 2687 of these prescribers in Scotland were independent prescribers.[6] Evidence has arisen in the intervening period indicating that nurse prescribing improves patient care, primarily through patient convenience, time saving, improvement in adherence to medication and the prevention of relapses due to greater involvement of the patient in the decision-making about their care. [7-11] It therefore seems likely that this increasing trend in the prevalence of nurse prescribers will continue.

Antimicrobial resistance (AMR) is now an urgent public health concern and threatens to reduce the effectiveness of how infections are treated.[12] Although the development of AMR is a complex evolutionary process it is accepted that the driver for the development of resistance is use of antibiotics and that resistance is greatest where use is greatest.[13] The scale of the threat from AMR and the case for action in the UK was recently set out in a five year strategy[14] and an action plan to deliver this in Scotland was set out in “The Scottish Management of Antimicrobial Resistance Action Plan 2014-18 (ScotMARAP2)”.[15]

Improving antibiotic prescribing is one of the fundamental objectives, featuring in both strategy documents, in tackling AMR. The ScotMARAP2[15] document recognises the requirements to develop multi professional expertise in antimicrobial stewardship, including non-medical prescribers in the light of emerging evidence of the influence of this group of professionals.

A series of case studies[16], involving nurse prescribers across acute and primary care settings in Scotland, indicated that nurses may be well placed to optimise antibiotic prescribing. This is due to the greater time spent with, and often knowledge of, the

patient and their accessibility to provide timely prescriptions. Nurses have always played key roles in infection prevention and control and so it would seem appropriate that they could have a role in controlling AMR through their prescribing behaviour and their role in managing public expectations of the need for an antibiotic prescription.[16] Nurse prescribers also have a key role in primary care, where 80% of antibiotic prescribing occurs.[17]

Given the imminent risk to public health from AMR and the impact that antibiotic prescribing has on this, it is important that nurse prescribing behaviour is explored; however there is a paucity of published evidence on the subject of antibiotic prescribing behaviour of nurse prescribers.[18]

Inappropriate antibiotic prescribing is a known problem in primary care;[19] what is unknown is the contribution of the growing body of nurse prescribers to this problem. Nurse prescribers work in a variety of settings, but especially within primary care where the majority of antibiotics are prescribed, thus understanding the prescribing behaviours of this body of prescribers is of particular importance. Accordingly, this paper aims to describe the quantitative patterns of primary care antibiotic prescribing by nurse prescribers in Scotland.

Methods

This was a retrospective analysis of a national prescribing dataset of nurse prescribers' practice over six years. The objectives of the analysis were to establish trends in the number and type of antibiotic items prescribed, in the percentage of all primary care prescribing, by NHS board and patient age group, and to explore compliance with national prescribing guidance. Scotland consists of 14 geographically based local NHS Boards which are responsible for the provision of community and hospital healthcare.

Data were obtained from the Prescribing Information System (PIS), an electronic database containing details of all NHS prescriptions dispensed in the community in Scotland. This is maintained by Information Services Division (ISD), part of NHS National Services Scotland (NSS). The information is supplied to ISD by the Practitioner and Counter Fraud Services strategic business unit of NSS who are responsible for the processing and pricing of all prescriptions dispensed in Scotland.

Data were accessed by a Senior Data Analyst employed by ISD Scotland who has permission to access this information. The other authors had no access to this raw data. The dataset analysed was aggregated and anonymised in accordance with ISD confidentiality rules and the Data Protection Act of 1998.[20] Outputs were produced by the analyst which contained no patient or prescriber identifiable information, therefore no ethical approval was required.

The PIS contains prescriber and dispenser information (geographical location) and prescription details (name, strength, formulation, quantity and cost of medicine). Since 2009 an increasing proportion of NHS prescriptions contain an individual's Community Heath Index (CHI) number thereby enabling analysis of prescribing information to be broken down by patient demographics such as age and gender. A CHI capture rate is always reported when presenting patient level analysis for reliability purposes. Generally a rate of over 90% is considered high enough to allow accurate patient analysis.[21] The completeness of CHI, and any confounding effect this may have, should be considered when interpreting the results.

Data on antibiotic prescribing in primary care presented in this report were derived from prescriptions written by nurses on GP10N prescription forms dispensed in the community. GP10N prescription forms are specific NHS prescription forms used by nurse prescribers. Data on nurse prescribing arising from Out of Hours Centres were

147 excluded due to differences in service delivery and access to medicines. Only data on
148 systemic antibiotics in BNF section 5.1 (antibiotic drugs), excluding 5.1.9
149 (antituberculosis drugs) and 5.1.10 (antileprotic drugs) except streptomycin were
150 included in the analysis.

151 Prescribing rates were calculated using National Records of Scotland (NRS) mid-year
152 population estimates which are based on the 2011 census.[22]

153 When comparing data with guidance compliance, Scottish Antimicrobial Prescribing
154 Group (SAPG) policy recommendations for type and dosage of antibiotic were used,[23]
155 and for Urinary Tract Infections (UTI), Scottish Intercollegiate Guidelines Network
156 (SIGN) guidelines were applied. UTIs are a common reason for consultation in primary
157 care. National guidelines state that non-pregnant women of all ages with signs and
158 symptoms of acute lower UTI should be treated empirically with trimethoprim or
159 nitrofurantoin for three days.[24]

160

161 **Results**

162 In 2013 there were 173,664 prescription items for antibiotics, prescribed by nurses in
163 Scotland. This represents 18.6% of all prescribing by independent nurse prescribers.
164 Since 2007, there has been a steady increase in both the rate of antibiotic prescribing
165 and the proportion of antibiotic prescribing in primary care undertaken by nurse
166 prescribers (**Figure 1**). In 2013, prescriptions written by nurses accounted for 4.3% of
167 all primary care antibiotic items.

168 In 2013, 902 nurses prescribed antibiotics on at least one occasion. Although the
169 average number of antibiotic items per nurse was 193 in 2013, the 10% who prescribed
170 antibiotics most frequently accounted for 56.0% of total prescribing by nurses. The 25%

most frequent prescribers accounted for 84.5% of total prescribing in the same year. As well as variability between prescribers there was also considerable variability in the rate of prescribing of antibiotics between the 14 NHS boards in Scotland with an 11 fold difference between the NHS board with the highest and the lowest prescribing rate (**Figure 2**). This may reflect differences in the numbers of nurse prescribers and configuration of service delivery within NHS boards across Scotland.

Adults, aged from 15 years, accounted for 86.1% of the antibiotic prescriptions written by nurse prescribers in 2013 (**Figure 3**) with 29.6% of prescriptions being for those aged from 60 years of age.

Since 2007, in primary care, there has been an increasing trend in nurses prescribing antibiotics that are recommended by the SAPG for first line empirical treatment of infection (amoxicillin, clarithromycin, doxycycline, erythromycin, flucloxacillin, nitrofurantoin, phenoxymethylpenicillin and trimethoprim) (**Figure 4**). In 2013, these first line antibiotics accounted for 92.7% of total antibiotic prescriptions. Moreover, since 2007, there has been a reduction in the proportion of the prescribing of broad spectrum antibiotics (cephalosporins; clindamycin; co-amoxiclav and fluoroquinolones) that are associated with an increased risk of *Clostridium difficile* infection (CDI). By 2013 these antibiotics accounted for only 3.9% of total antibiotic nurse prescribing and could be a useful measure of prescribing quality.

The number of items prescribed for UTI with a three day duration, as a proportion of total items of trimethoprim, may be another useful measure of prescribing quality. Since 2007 there has been an increasing trend in the proportion of total trimethoprim prescriptions in adult females for three day duration (**Figure 5**). In 2013, 71.3% of all prescriptions for trimethoprim in adult females were of three day duration.

Amoxicillin is the most commonly prescribed antibiotic by nurses in Scotland accounting for 30.2% of total antibiotic prescriptions in 2013. Evidence based prescribing guidelines implemented in Scotland since 2008 include dosage recommendations for adults. In the case of amoxicillin, the recommended dose in adults is generally 500mg. The proportion of all amoxicillin prescription items for 500mg capsules is a third useful measure of prescribing quality, representing compliance with prescribing guidelines. From 2007 to 2013 there has been an increase from 58.9% to 87.2% of amoxicillin 500mg capsules as a proportion of all amoxicillin capsules prescribed by nurses (**Figure 5**).

Discussion

Our analysis, which we believe is the first descriptive analysis of nurse antibiotic prescribing at a national level, indicates that the volume of prescribing of antibiotics by nurses has increased since 2007 (both in the number of number of nurses prescribing at least one antibiotic and in the volume of antibiotics prescribed) and is becoming an increasing contributory influence to total antibiotic prescribing in primary care. There is very little other published evidence with which to compare these results. Only three studies were found in the literature which explored the antibiotic prescribing practice of independent nurse prescribers. Nutall et al[25] conducted a six month audit of three prescriber-trained nurse practitioners in one primary care setting in the United Kingdom which, like our data, also found that amoxicillin was the most commonly prescribed antibiotic. Of the 1296 antibiotic prescriptions written during this audit, only 200 did not adhere to practice guidelines; however, these were accompanied by clear clinical indication in the medical record. The two other studies found in the literature compared the antibiotic prescribing practice of independent nurse prescribers with General

Practitioners (GP) and found no significant differences in patient recovery rates or antibiotic prescription rates between GPs and practice nurses.[26-27] The latter of these studies was based in the US and so cognisance should be taken with regard to differences in the delivery of healthcare and practitioner education

The data indicate that in 2013 only a small percentage of qualified nurse prescribers prescribed any antibiotics and that the 25% most frequent prescribers accounted for 84.5% of total antibiotic prescriptions. This is most likely to be due to difference in roles, for example, practice nurses running minor illness clinics may be more likely to see patients with infections requiring antibiotics than health visitors. There is also considerable variability in the rate of antibiotic prescribing across Scottish NHS boards. Again this may be due to differences in nursing roles within each NHS Board. This variation means that a change in prescribing roles, through service delivery, could have an impact on the contribution to primary care antibiotic prescribing made by nurses. For example, an increase in the number of nurses managing minor illness clinics rather than GPs.

In the current analysis we cannot make any assessment of the appropriateness of antibiotics prescribed; however, these data indicate improving trends in the prescription of first-line and high-risk antibiotics together with improvements in quality prescribing indicators. The proportion of total antibiotic prescribing by nurses, with first line recommended antibiotics, is higher than observed in all prescribers in primary care and nurses account for a lower proportionate number of higher risk antibiotics.[28] The initial priority for SAPG, following its establishment in 2008, was the development of prescribing policies to improve the quality of prescribing of antibiotics through influencing the choice of antibiotic for empirical treatment of infection. These policies were intended to recommend the use of narrower spectrum agents at the expense of those broader spectrum agents which are associated with a higher risk of CDI. From

these data it may be possible to suggest that these interventions, aimed at formulary compliance, are having a positive impact on nurse prescribers.

This analysis has some limitations. The data on nurse prescribing includes only antibiotics dispensed on NHS GP10N nurse prescription forms and therefore does include any private (non-NHS) nurse prescribing. However, we believe antibiotic prescribing by nurses on a private basis will be very low. The rate of capture of CHI numbers on prescriptions written by nurses was 49.4% and accordingly we cannot be sure if the patterns described are generalisable to all nurse prescribing. Also, the data do not include nurse prescribing in other settings where antibiotics may be prescribed such as out-of-hours and minor illness/injury clinics, as well as within secondary care or in situations where nurses influence medical prescribing or where supplementary prescribing occurs i.e. nurses are in a voluntary partnership with medical staff to prescribe in a patient- specific clinical management plan. Accurate data on the number of nurse independent prescribers, working in the community is, at present, unavailable; however, a current scoping exercise of nonmedical prescribers by The Scottish Government should soon be able to provide this information. This means that it is difficult to draw any conclusions regarding the percentage of qualified prescribers who are currently prescribing antibiotics. The final limitation of this analysis is that we cannot say if the prescribing was appropriate or not. Some studies have been carried out to explore this in greater detail by focussing on the influences on antibiotic prescribing behaviour in nurse prescribers[29-34] but these were limited by relatively poor response rates, small sample sizes, and designs with no reported underpinning theory.

Conclusion

In conclusion, nurse prescribing of antibiotics within primary care is increasing each year in Scotland. An analysis of prescribing data in Scotland has shown that this practice varies across the NHS boards and between prescribers but that, on average, antibiotics account for one in every five prescriptions written by a nurse prescriber. The importance of nurse prescribing will only grow and groups working on antimicrobial stewardship interventions must include nurses in their approach or risk losing the ability to influence a large body of antibiotic prescribers. More information is needed to establish if nurse prescribers are prescribing appropriately, although some quality indicators may suggest they are currently following best practice.

It has been shown that targeted education interventions can lead to improvements in antibiotic prescribing among general medical prescribers.[35] This quantitative data has described nurse antibiotic prescribing patterns in Scotland for the first time but further research, including qualitative data, is also required if we are to establish a better understanding of nurse antibiotic prescribing behaviour and the influences on this behaviour. Only then will there be an ability to target interventions appropriately to improve antibiotic prescribing.

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Transparency Declaration: None to declare

Contributions: VN, WM & JR wrote the article, GMcG analysed the data and produced the figures

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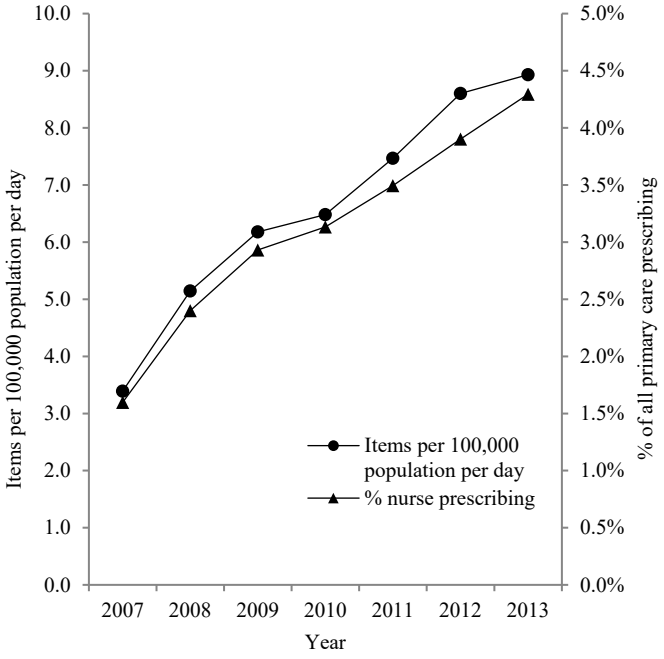
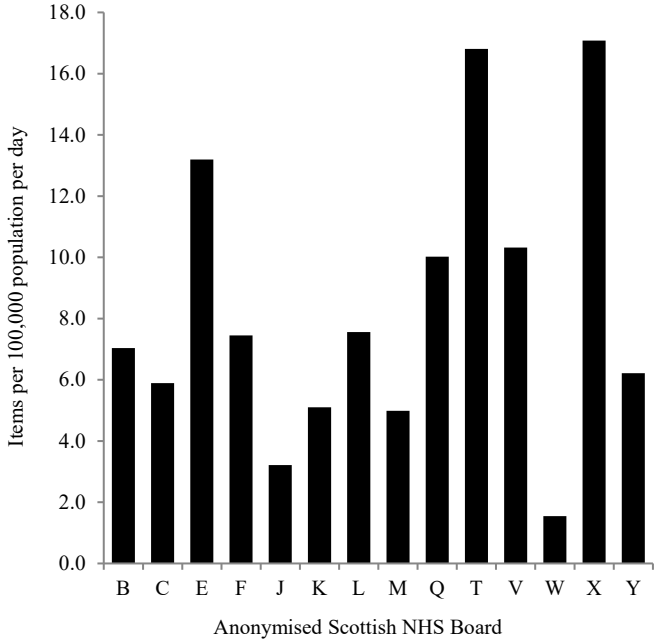


Figure 1. Number of antibiotic items prescribed by nurse prescribers per 100,000 population per day and nurse prescribing as a percentage of all primary care prescribing in Scotland



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426 Figure 2. Nurse antibiotic prescribing in 2013 broken down by Scottish NHS Board

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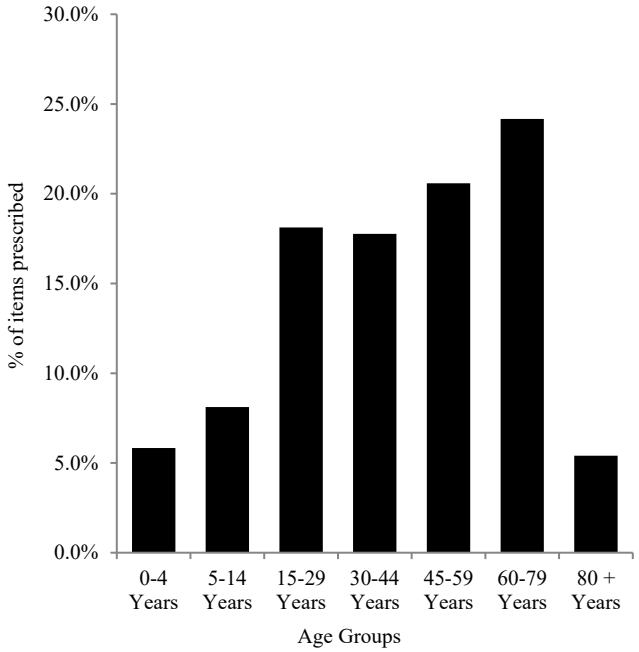

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440 Figure 3. Nurse antibiotic prescribing in 2013 broken down by age group prescribed - CHI
441 Capture 49.4%

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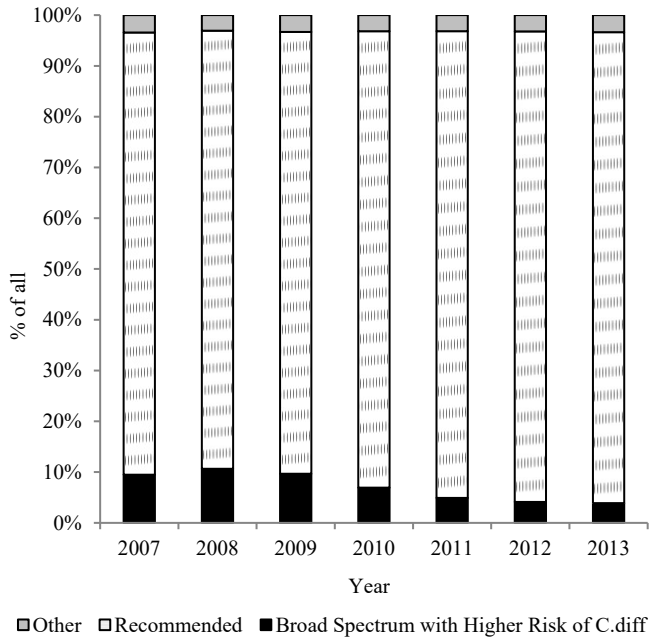
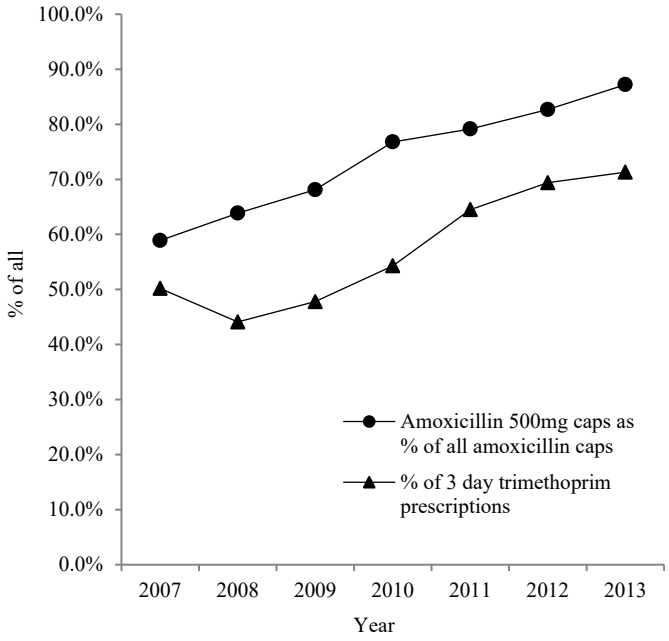


Figure 4. Nurse antibiotic prescribing broken down as broad spectrum antibiotics with a higher risk of *Clostridium difficile*, recommended and other antibiotic categories



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465 Figure 5. Nurse antibiotic prescribing - Quality measures - amoxicillin 500mg capsules as a
466 percentage of all amoxicillin capsules and 3 day trimethoprim as a percentage of all
467 trimethoprim prescriptions for urinary tract infections